Research Article

The Effect of Coffee in the Prevention of Oral Mucositis Associated with Head and Neck Radiotherapy

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Abstract

AIM: This study investigates the effect of coffee on the management of oral mucositis associated with head and neck radiotherapy.
METHOD: Twenty-nine patients who underwent radiotherapy for the first time due to head and neck cancer between March 2019 and February 2020 were included in the experimental study. One cup/day of Turkish coffee (6 mg) was given to the patients in the intervention group every day for 3 weeks from the first day of radiotherapy. Data monitoring of both groups was performed once a week for 3 weeks.
RESULTS: Most of the patients participating in the study were at local stage (65.2%), and 72.4% underwent head and neck radiotherapy with the diagnosis of nasopharynx and larynx cancer. Although the development rate of oral mucositis was lower in the intervention group, no statistically significant difference was determined ($p > 0.05$). In the repeated follow-up, the quality of life scores was found to be similar in both groups.
CONCLUSION: We concluded that coffee application is not an effective approach in the prevention of oral mucositis associated with head and neck radiotherapy. Further studies with larger sample sizes are needed to determine the prophylactic effect of coffee in the management of oral mucositis.
Keywords: Coffee, head and neck cancer, mucositis, radiotherapy

Introduction

Radiotherapy (RT) alone or in combination with surgery and chemotherapy is one of the most commonly applied treatment approaches in the treatment of head and neck cancers (HNCs) (Pfister et al., 2020). During RT, oral mucositis, infections, changes in saliva secretion, fibrosis, sensory disorders, dental caries, periodontal disease, and osteoradionecrosis may be seen in patients (Sroussi et al., 2017). Oral health of a patient is severely affected, especially when the oral cavity and major salivary glands remain within the RT area (Chrcanovic et al., 2010). In a study, it was stated that 90% of patients with HNC who were undergoing RT had dryness of the mouth, 95% had weight loss, and 82% had grade 1–2 mucositis (Akkaş et al., 2013). Besides, it is also stated in the literature that oral mucositis is one of the most problematic symptoms of patients with HNC, and 12% of patients have swallowing difficulty due to oral mucositis, 3% have dehydration due to oral mucositis, 3% use opioid-derived analgesic due to pain caused by oral mucositis, 30% have weight loss due to oral mucositis, and 63% skip or reduce the dose of treatment associated with oral mucositis (Trotti et al., 2003). Oral mucositis due to RT, which develops generally between the third and twelfth weeks of the treatment, causes patients to use more opioid-derivative painkillers and also need

nutritional supplements (Jensen & Peterson, 2014; Pfister et al., 2020). In addition, since the infection rates in these patients are higher than those without mucositis, the hospitalization duration prolongs and the mortality due to sepsis increases. Besides, patients may experience problems in receiving and completing the treatment cures especially related to infection, because of all these problems they experience. Therefore, prevention and treatment of oral mucositis, which causes the general condition of these patients to deteriorate and their quality of life to impair, are important (Al-Ansari et al., 2015).

Caffeine is a natural alkaloid found in coffee, tea, cola drinks, and cocoa (Pereira et al., 2006). In addition, caffeine is hypoalgesic and has antioxidant and anti-inflammatory effects (Henderson-Smart et al., 2010; Pereira et al., 2006; Welsh et al., 2010). Coffee, containing caffeine, has antioxidant properties by itself or with its specific compounds and has protective effects against oxidative DNA damage, liver lesions (hepatotoxic fibrosis), and tissue damage (Furtado et al., 2012). Coffee exhibited activity against oral bacteria associated with the caries lesion, *Streptococcus mutans*. Coffee and its extracts demonstrate promising benefits to oral health, especially for diseases that are considered biofilm dependent, such as dental caries and periodontal diseases (Fidalgo et al., 2019). Efficacy

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of coffee in the management of oral lesion has been investigated in two small-sized studies, one of which was case–control studies. The first study conducted by Galeone et al. in 2010, which included nine HNC patients, found an inverse association between coffee drinking and the risk of cancer of the oral cavity and pharynx (Galeone et al., 2010). In another randomized controlled study, the effects of topical steroids, honey, and honey and coffee combination in the management of oral mucositis caused by chemotherapy were compared. In this study, the beneficial effects of honey and coffee combination in relieving oral mucositis have been reported. In the literature show that every treatment reduced lesion severity, which suggests that oral mucositis can be successfully treated (Raeessi et al., 2014). It has been also reported that local use of honey alone is effective in preventing oral mucositis associated with RT (Münstedt et al., 2019; Tian et al., 2020; Yang et al., 2019). However, when the literature is examined, no study was found to investigate the effect of coffee alone in the prevention of oral mucositis associated with RT. This study was conducted to evaluate the effect of coffee in the prevention of oral mucositis associated with the treatment in patients undergoing head and neck RT.

Hypotheses

H1: Coffee in patients diagnosed with head and neck cancer prevents the development of treatment-related oral mucositis.

H2: Coffee in patients diagnosed with head and neck cancer reduces the severity of treatment-related oral mucositis

H3: Coffee in patients diagnosed with head and neck cancer delays the development of treatment-related oral mucositis.

H4: Coffee enhances the quality of life in radiotherapy due to head and neck cancer.

Method

Study Design
A randomized controlled design was used in the study. The study complied with guidelines outlined under the Consolidated Standards of Reporting Trials (CONSORT) checklist (Hemming et al., 2018).

Population and Sample of the Study
The study was conducted between March 2019 and February 2020 in a head and neck RT outpatient clinic of a training and research hospital located in Istanbul.

Patients who started to receive RT for the first time due to diagnosis of HNC, patients who can eat orally, and patients older than 18 years and who agreed to participate in the study were included in the study. The patients with developed grade 0 or higher oral mucositis and known coffee allergy according to National Cancer Institute (NCI) toxicity criteria were excluded from the study.

When the predicted aveage effect size was 1.153 as a result of the power analysis (G*Power v3.1.7) for the management of oral mucositis in patients receiving RT for HNC, the minimum sample size determined for Power:0.95, β: :0.05 and α: :0.05 was determined as 26 people, at least 13 for each group (Raeessi et al., 2014). During data collection, a total of 108 patients meeting the study criteria and constituting the population of the study were reached. Seventy-eight patients were excluded from the study since they did not agree to participate in the study after making an explanation about the study. Thirty patients included in the study were divided into two groups: intervention group [coffee + standard care ($n = 15$)] and the control group [standard care group ($n = 15$)]. Groups used a randomization checklist prepared using the MS Excel program. During the study, a patient who wanted to leave the study was excluded, and the study was completed with the participation of a total of 29 patients in total [intervention group ($n = 14$) and control group ($n = 15$)] (Figure 1).
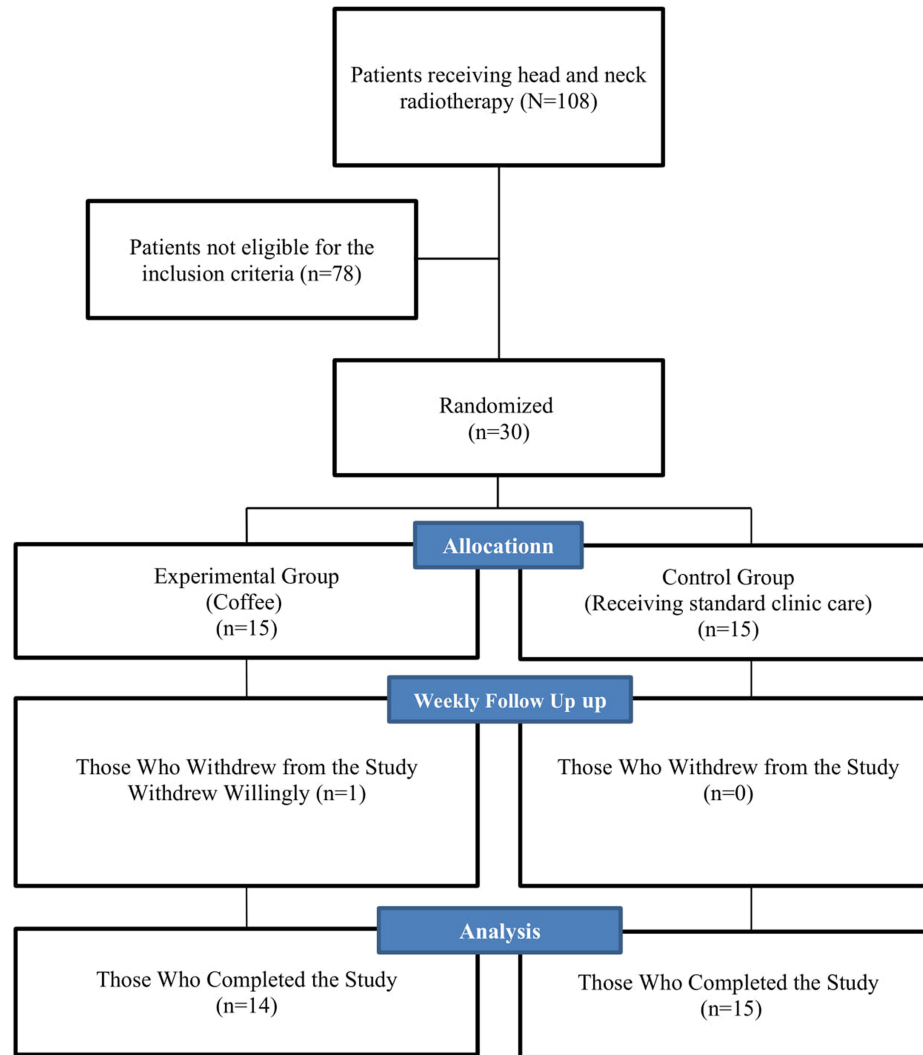
Data Collection

First Interview with the Patient: In the first interview with the patient, the personal characteristics of the patients and their treatment-related characteristics that may play a role in the development of oral mucositis were evaluated by using patient information form.

In the first interview with the patient, the patient's personal characteristics and treatment characteristics that may play a role in the development of oral mucositis were evaluated using the patient information form.

Patient Follow-Up: The development of oral mucositis in patients was followed up throughout the RT process. Since RT-induced mucositis usually started in the second week of treatment, patients were followed up for 3 weeks. Oral mucositis severity, Beck oral mucosal assessment, and the effect of oral mucositis on the quality of life were evaluated using the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire—H&N35 (EORTC QLQ-H&N35) scale, by calling the patients in both groups once a week (approximately 10–15 minutes). In addition, patients in the intervention group were asked whether or not they were drinking coffee every day, and their answers were recorded by the researcher. The decision was made with the radiation oncologist and researcher depending on the patient's self-report or examination.

Data Collection Tools

Patient information form: The patient information form prepared by the researchers in accordance with the literature is composed of 20 questions evaluating the personal characteristics of the patients, such as gender, age, education status, occupation, marital status, economic status, working status, health insurance, their characteristics related to disease/treatment process such as cancer diagnosis, status of receiving surgical treatment about HNC, the field and dose of RT application and status of receiving simultaneous chemotherapy, their characteristics associated with oral care such as regular tooth brushing, whether to have oral examination by visiting a dentist before starting the treatment, and smoking and alcohol status.

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┌─────────────────────────────┐
│ Patients receiving head and  │
│   neck radiotherapy (N=108)  │
└─────────────────────────────┘
              │
┌────────────────────────┐    │
│ Patients not eligible   │    │
│ for the inclusion       │────┤
│ criteria (n=78)         │    │
└────────────────────────┘    │
              │
┌──────────────────┐
│   Randomized     │
│    (n=30)        │
└──────────────────┘
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Allocationn

Experimental Group
(Coffee)
(n=15)

Control Group
(Receiving standard clinic care)
(n=15)

Weekly Follow Up up

Those Who Withdrew from the Study
Withdrew Willingly (n=1)

Those Who Withdrew from the Study
(n=0)

Analysis

Those Who Completed the Study
(n=14)

Those Who Completed the Study
(n=15)

Consort Flow Diagram

Figure 1.
The Flow Diagram for This Study.

National Cancer Institute common terminology criteria for adverse events—version 5.0: The fifth version of the NCI toxicity criteria, published in 2017, was used in the toxicity evaluation. In this classification, the severity of oral mucositis is classified as follows: 1, exists but there is no or mild complaint about mucositis; 2, there is moderately painful mucositis that does not prevent eating but requires a change in its type; 3, severe and painful mucositis that prevent eating; 4, medical intervention is urgently needed; and 5, death. Higher scores indicate the increased severity of the problem (CTCAE, 2020).

Beck oral mucosa assessment guideline: Oral assessment guideline developed by Beck is a diagnostic form used to evaluate the integrity of the oral mucosa by questioning the patient and examining the oral region visually. In the oral assessment guideline consisting of eight sections, the changes in voice, swallowing, lips, tongue, saliva, mucous membrane, gums, teeth, or prostheses are scored using the numerical

values of 1, 2, and 3. It supports the formation of oral care protocol to be given to the patient whose oral mucous membrane is distorted. While the lowest score of the guideline is 8, the highest score is 24. As the score increases, oral complaints increase, and the severity of mucositis development is evaluated (Beck et al., 2007).

European Organization for Research and Treatment of Cancer Quality of Life Questionnaire—H&N35: European Organization for Research and Treatment of Cancer Quality of Life Questionnaire—H&N35, which was developed by Bjordal et al., in 1999, is an assessment tool with 35 items used to better evaluate the quality of life of patients with head HNC. There are 11 single-item subscales relating to teeth, opening the mouth, dry mouth, sticky saliva, coughing, feeling ill, painkillers, nutritional supplements, feeding tube, weight gain, and weight loss. Quality of Life Questionnaire—H&N35 also includes 24 items in seven subscales as follows: pain (4

items), swallowing (4 items), sense problems (2 items), speech problems (3 items), trouble with social eating (4 items), trouble with social contact (5 items), and less sexuality (2 items). Thirty-five items in the scale are Likert type and the answers are evaluated by giving none "1" point, a little "2" points, quite "3" points, and a lot "4" points. High scores taken from these sections indicate more symptoms and problems and low scores refer to less symptom and problems. The × 100 formula is used while calculating the scale score (Bjordal et al., 1999).

Coffee Application: While the standard protocol of the clinic (tooth brushing, oral care with oral care set, and antifungal treatment according to the culture result) was applied to the control group, the intervention group was asked to drink 1 cup/day (70 mL). The patient was asked to prepare the coffee (6 mg) according to the preparation instructions on the back of the single-use coffee packages: (i) use a coffee cup to measure drinking water and put it in the special coffee pot called cezve; (ii) add the coffee package; (iii) heat slowly, stirring well, until the coffee stars to foam; (iv) gently pour a little of the foam into each cup; and (v) bring the coffee to another boil, and gently fill each cup or (you can prepare the specified amount in the coffee machine). Turkish coffee was given every day from the first day of RT for 3 weeks along with the standard protocol. The daily coffee amount was given in packages to the patients.

Turkish coffee was used in the study. This is because Turkish coffee is easily discernible from other types of coffee due to its unique aroma and foam and contains less caffeine in one serving than other types of coffee. Turkish coffee was supplied by a company with BRC (Food British Retail Consortium), ISO 9001 (Quality management system), ISO 22000 (Food Safety Management System), and OHSAS 18001 (Occupational health and safety management systems) quality certificates.

Study Termination Criteria
Development of severe oral mucositis associated with RT or discontinuation of the treatment was considered as the primary termination criterion.

Statistical Analysis
The evaluation of the data was carried out in the IBM Statistical Package for the Social Sciences (IBM SPSS Corp.; Armonk, NY, USA) version 21 packet program. Descriptive statistical methods (e.g., percentage, mean, standard deviation, frequency, ratio, minimum, and maximum) were used. In the study, the independent samples t-test/Mann–Whitney U-test and the chi-square test were used. The significance was evaluated at the 95% CI at the levels $p < 0.01$ and $p < 0.05$.

Ethical Considerations
This study was conducted in accordance with the Helsinki Declaration principles. Written permission was obtained from the Ethics Committee of Istanbul Sabahattin Zaim University (Date: August 14, 2018, Number: 3608). In addition, verbal and written consents were obtained from the participants after they were informed about the study.

Results

It was found that most of the patients participating in the study were male (65.5%), married (72.4%), and secondary school/high school graduates (58.6 %). The income level of the patients, most of whom were unemployed (65.9%), was moderate (89.3%). There was no difference between both groups in terms of dental health results, and all patients brushed their teeth regularly and completed the dentist's control before treatment (p > 0.05). Half of the patients were smokers (51.6%), but most of the patients did not use alcohol (75.8%). İn conclusion, there was no statistically significant difference between the personal characteristics and dental health status of the patients randomized to the intervention (n = 14) and control (n = 15) groups (p > 0.05) (Table 1). Patients who were at local stage (65.2%) and who underwent head and neck RT with a diagnosis of nasopharynx and larynx cancer (72.4%) participated in the study. While chemoradiotherapy was applied to two-thirds of the patients, it

Table 1.
Sociodemographic Characteristics of the Patients (n = 29)

	Control Group (n=15)		Intervention Group (n=14)			
	n	%	n	%	χ^2	p
Gender						
Male	10	66.7	9	64.3	0.01[a]	1.00
Female	5	33.3	5	35.7		
Marital status						
Married	11	73.3	10	71.4	0.01[a]	1.00
Single	4	26.7	4	28.6		
Educational status						
Primary school	6	40.0	6	42.9	0.51	0.77
Secondary school/high school	9	60.0	8	57.2		
Occupational status						
Working	7	46.7	3	21.4	1.07[a]	0.29
Not working	8	53.3	11	78.6		
Economic status						
Moderate	15	100.0	11	78.6		0.10[b]
Bad	0	0.0	3	21.4		
Brushing teeth						
Every day, regular	15	100.0	15	100.0	—	—
Smoking						
No	7	46.7	7	50.0	0.32	0.86
Yes	8	53.3	7	50.0		
Drinking alcohol						
No	12	80.0	10	71.4	0.01[a]	0.91
Yes	3	20.0	4	28.6		

[a]Continuity correction.
[b]Fisher's exact test.

was determined that most of them (61.9%). did not receive surgical treatment before the treatment. Characteristics related to the disease were similar in both groups.

When examining the mucositis-related results in the intervention and control groups, it was found that mucositis developed

Table 2.
Disease- and Treatment-Related Characteristics

	Control Group (*n* = 15)		Intervention Group (*n* = 14)			
	n	%	*n*	%	χ²	*p*
Diagnosis						
Oral cavity	4	26.7	4	28.6	0.01[a]	1.00
Nasopharynx and larynx	11	73.3	10	71.4		
Disease stage						
Stage II	11	73.3	8	57.1	0.28[a]	0.60
Stage III	4	26.7	6	42.9		
Presence of metastases						
No	11	73.3	7	50.0	1.68	0.19
Yes	4	26.7	7	50.0		
Surgical treatment						
Not performed	10	66.7	8	57.1	0.30	0.60
Performed	5	33.3	6	42.9		
Current treatment						
Radiotherapy	10	66.7	9	64.3	0.01[a]	1.00
Chemoradiotherapy	5	33.3	5	35.7		
Cycle range						
q7	1	20.0	2	40.0		1.00[b]
q21	4	80.0	3	60.0		
Pre-treatment dental examination						
Yes	15	100.0	14	100.0	—	—
Oral mucositis						
First interview						
Grade 0	15	100.0	14	100.0	—	—
Second interview						
Grade 0	1	6.7	3	21.4	0.01[a,c]	1.00
Grade 1	9	60.0	7	50.0		
Grade 2	5	33.3	4	28.6		
Third interview						
Grade 1	4	26.7	8	57.1	2.77	0.09
Grade 2	11	73.3	6	42.9		

[a]Continuity correction.
[b]Fisher's exact test.
[c]Grade 0–1 vs. grade 2.

in the second week of the treatment and the severity increased in the third week of the treatment, and there was no difference between (*p* > 0.05) the weekly average values of oral mucositis severity in both groups [Table 2 (G0–1 vs. G2+)].

When the effect of coffee on preserving the oral mucosa integrity in the control and intervention groups was evaluated, it was determined that the Beck oral mucosa assessment scores of both groups in the first, second, and third weeks were similar, and there was no statistically significant difference between the two groups (*p* > 0.05) (Table 3).

The Effect of Coffee on European Organization for Research and Treatment of Cancer Quality of Life Questionnaire—H&N35
When examining the results of coffee on the quality of life in the intervention and control groups, it was determined that the general quality of life of both groups was similar, and there was no statistically significant difference between the two groups during follow-ups in the weeks 1, 2, and 3 of RT (*p* > 0.05).

It was found that the most frequently expressed three problems by the patients in the first week of RT were coughing, dry mouth, and speech problems, respectively, and there was no statistically significant difference between the two groups in terms of problems affecting the quality of life (*p* > 0.05).

The most frequently expressed three problems by the patients in the second week of RT were determined as the need for using additional nutrients/pills, weight loss, and pain medication, respectively, and there was no statistically significant difference between the two groups in terms of problems affecting the quality of life (*p* > 0.05).

The most frequently expressed three problems by the patients in the third week of RT were determined as the need for analgesics, salivation problems, and teeth problems. Speech problems, impaired social communication, and decreased sexuality were experienced more in the control group compared to the intervention group in the third week of RT. (Table 4).

Discussion

Radiotherapy is widely used alone or in combination with chemotherapy in the treatment of patients diagnosed with HNC. Along with treating the disease, this treatment method also causes many side effects such as skin reactions, oral mucositis, dry mouth, and taste changes. Particularly, oral mucositis among these problems negatively affects the quality of life of the patients since they cause deterioration in their social relations and daily life activities such as oral intake and eating. It was reported in the studies that the incidence of grade 3–4 oral mucositis associated with RT was 25–40% in patients with HNC (Nguyen-Tan et al., 2014; Posner et al., 2007).

When examining the mucositis incidence in the intervention and control groups according to the RT week in the present study, there was no difference between both groups in the second and third weeks (Table 3). While the development of grade 1–2

Table 3.
Distribution of Properties Associated with Oral Mucosa

	Interview	Control Group (n = 15)			Intervention Group (n = 14)			z_{MWU}	p
		$\bar{x}$	SD	Mean Rank	$\bar{x}$	SD	Mean Rank		
Beck Oral Mucosa Assessment	First	8.47	0.52	15.80	8.43	0.76	14.14	−0.61	0.62
	Second	10.13	1.36	15.23	10.00	1.18	14.75	−0.16	0.88
	Third	11.60	1.76	16.10	11.14	1.46	13.82	−0.74	0.48

oral mucositis in the intervention group in the second week was 39.3%, it was 46.7% in the control group. In a study conducted on this subject, it was reported that grade 1–2 oral mucositis was developed by 43% in patients during RT (Nicolatou-Galitis et al., 2011). In another study, it was reported that the rate of grade 1 mucositis associated with RT was 8% in patients with HNC, and the rate of grade 2 mucositis was reported as 43% (Elting et al., 2007). As a result, it was determined that coffee did not decrease the incidence of oral mucositis. In the present study, grade 3 and above oral mucositis was not seen in the first 3 weeks. This situation may be attributed to the recent widespread use of RT with high sensitivity such as intensity-modulated radiotherapy as well as the decrease in the incidence of side effects due to RT (Kawashita et al., 2020).

When the literature is examined, oral hygiene (including optimization of the tooth structure before RT) and diet modifications are frequently used in the management of oral mucositis associated with RT in patients with HNC. In addition, many approaches such as oral care protocols (multiagent combination oral care protocols), anti-inflammatory agents (benzydamine), laser therapy (low-dose helium–neon laser therapy), antimicrobial, anesthetic, and analgesic drugs [morphine, sucralfate, mucoadhesive hydrogel, doxepin (topical), fentanyl (transdermal), growth factors and cytokines (KGF-1)], and natural and miscellaneous products (oral glutamine, honey, and honey–coffee combination) are used (Galloway et al., 2019). It has been reported in the literature that honey application is an effective non-pharmacological approach that can be used in the prevention of mucositis, and according to a meta-analysis result, oral honey application during the RT treatment process reduced the severity of mucositis (Amanat et al., 2017). In a study conducted on this subject, it was reported that honey–coffee mixture could be effective in the management of this problem (Raeessi et al., 2014).

Coffee, which is a caffeine substance, has many effects on health. Chlorogenic acid in coffee increases the plasma homocysteine concentration. Caffeine is also hypoalgesic and has antioxidant and anti-inflammatory effects. Coffee exhibited activity against oral bacteria associated with the caries lesion, *Streptococcus mutans* (Diener et al., 2014; Fidalgo et al., 2019; Salehi et al., 2019). Additionally, while diterpenoid in unfiltered coffee increases low-density lipoprotein cholesterol, it lowers high-density lipoprotein cholesterol (Bryan Bordeaux et al., 2020). Coffee was used in the treatment of many diseases such as cognitive/neuropsychiatric diseases (e.g., Parkinson's disease, Alzheimer's disease, and psychiatric symptoms) (Zhang et al., 2021), cardiovascular diseases (e.g., Myocardial infarction and arrhythmia) (Crippa et al., 2014; Surma & Oparil 2021; Yuan

et al., 2021), endocrine diseases (e.g., insulin resistance and type 2 diabetes mellitus) (Alperet et al., 2020; Goto et al., 2011), gastrointestinal diseases (e.g., constipation and cirrhosis) (Liu et al., 2015; Nehlig, 2022), prophylactically in cancer (Crippa et al., 2014; Tang et al., 2010; Yang et al., 2015), and musculoskeletal diseases (e.g., osteoporosis, arthritis, and gout) (Mascitelli & Goldstein, 2011).

In a randomized controlled double-blind study conducted about the management of oral mucositis induced by chemotherapy, the effects of topical steroid, honey, and honey–coffee combination were compared. The patients were divided into three groups such as steroid (n = 21), honey (n = 20), and honey–coffee (n = 21). A 600 g of mixture in the form of syrup was applied to each of them (steroid group = 20 amp betamethasone, honey–coffee mixture group = 300 g of honey and 20 g coffee, and honey group = 300 g honey). The patients were asked to swallow three teaspoons (10 mL) of the mixture every 3 hours for a week. It was reported in the study that honey and coffee mixture was a better treatment method in decreasing the severity of oral mucositis and showed an effect in a shorter time period compared to topical steroids (Raeessi et al., 2014).

In the present study, while the control group received the standard protocol of the clinic, the patients in the intervention group were asked to drink 1 cup (70 mL) of Turkish coffee (6 mg) once every day for 3 weeks from the first day of RT in addition to the standard protocol. It was determined that the mucositis severity was similar between the groups; mucositis developed in the second week of the treatment in both groups, its severity increased in the third week of the treatment, and there was no difference between the weekly average values of oral mucositis severity.

It is reported that oral mucositis associated with RT usually develops between the second and third weeks of treatment (Elting et al., 2007). Similar to the literature, in the present study, oral mucositis was observed to develop in the second week in both groups. Therefore, it was believed that coffee did not delay the development of oral mucositis.

In addition, when the quality of life scores were compared between the groups, it was determined that the general quality of life of both groups was similar in the first, second, and third week follow-ups of the RT, and there was no statistically significant difference between both groups. Unlike the study by Raeessi et al., this result was believed to be caused by the fact that the coffee was drunk by cooling, Turkish coffee was used instead of Nescafe, the coffee was used alone, and the patients had different coffee drinking times (5–30 minutes).

Table 4.

Q7 *The Effect of Coffee on EORTC QLQ—H&N35*

	Interview	Control Group			Intervention Group			z_{MWU}	p
		x̄	SD	Mean Rank	x̄	SD	Mean Rank		
Pain	First	2.78	4.07	13.67	4.76	5.39	16.43	1.01	0.40
	Second	8.89	9.16	13.57	12.50	10.72	16.54	0.98	0.35
	Third	30.56	13.61	16.23	25.60	15.83	13.68	−0.82	0.42
Swallowing	First	0.56	2.15	13.47	2.38	3.91	16.64	1.53	0.33
	Second	6.11	10.19	14.37	7.14	10.26	15.68	0.46	0.68
	Third	21.11	11.73	16.43	17.26	14.05	13.46	−0.97	0.35
Senses problems	First	3.33	6.90	15.80	2.38	8.91	14.14	−0.87	0.62
	Second	5.56	10.29	14.13	9.52	14.19	15.93	0.69	0.59
	Third	25.56	25.09	15.60	20.24	19.81	14.36	−0.41	0.76
Speech problems	First	8.15	8.88	16.40	4.76	5.71	13.50	−1.04	0.38
	Second	8.89	8.61	14.50	9.52	5.94	15.54	0.36	0.74
	Third	37.78	14.43	18.07	24.60	15.21	11.71	**−2.05***	**0.046***
Trouble with social eating	First	6.11	9.69	17.23	1.19	4.45	12.61	−1.94	0.15
	Second	6.11	9.69	14.57	6.55	9.35	15.46	0.31	0.78
	Third	17.22	13.54	14.07	20.83	15.93	16.00	0.62	0.56
Impaired social communication	First	4.44	6.51	15.50	4.29	8.91	14.46	−0.38	0.75
	Second	8.44	11.12	13.47	11.90	10.52	16.64	1.04	0.33
	Third	33.78	14.79	20.00	16.19	9.68	9.64	**−3.32***	**0.001***
Less sexuality	First	1.11	4.30	14.97	1.19	4.45	15.04	0.05	1.00
	Second	11.11	13.61	14.90	11.90	15.23	15.11	0.07	0.94
	Third	37.78	13.31	18.77	19.05	19.46	10.96	**−2.56***	**0.01***
Teeth	First	6.67	13.80	15.40	4.76	12.10	14.57	−0.40	0.81
	Second	13.33	16.90	13.30	21.43	16.57	16.82	1.28	0.27
	Third	31.11	29.46	15.07	30.95	30.56	14.93	−0.05	0.98
Opening mouth	First	0.00	0.00	14.00	4.76	12.10	16.07	1.49	0.53
	Second	8.89	15.26	13.73	16.67	21.68	16.36	0.99	0.46
	Third	28.89	37.52	15.77	21.43	30.96	14.18	−0.56	0.62
Dry mouth	First	8.89	15.26	16.37	2.38	8.91	13.54	−1.37	0.38
	Second	11.11	16.27	12.33	23.81	15.63	17.86	2.01	0.09
	Third	31.11	23.46	15.77	26.19	19.30	14.18	−0.57	0.62
Sticky saliva	First	6.67	13.80	16.40	0.00	0.00	13.50	−1.74	0.38
	Second	6.67	13.80	13.90	11.90	16.57	16.18	0.93	0.48
	Third	35.56	29.46	15.13	33.33	26.15	14.86	−0.09	0.95
Coughing	First	15.56	17.21	15.27	14.29	17.12	14.71	−0.20	0.88
	Second	11.11	16.27	13.33	19.05	17.12	16.79	1.26	0.29
	Third	20.00	21.08	15.00	19.05	17.12	15.00	0.01	1.00
Feeling sick	First	2.22	8.61	14.97	2.38	8.91	15.04	0.05	1.00
	Second	6.67	13.80	14.40	9.52	15.63	15.64	0.53	0.72
	Third	37.78	39.57	15.93	26.19	26.73	14.00	−0.65	0.56
Need for analgesics	First	2.22	8.61	14.47	4.76	12.10	15.57	0.66	0.75
	Second	17.78	24.77	14.80	19.05	25.20	15.21	0.15	0.91
	Third	51.11	37.52	16.80	35.71	27.62	13.07	−1.24	0.25
Nutritional supplements	First	4.44	11.73	13.93	9.52	15.63	16.14	0.99	0.51
	Second	20.00	16.90	12.90	30.95	15.82	17.25	1.70	0.17
	Third	31.11	26.63	15.13	28.57	22.10	14.86	−0.09	0.95
Feeding tube	First	2.22	8.61	14.97	2.38	8.91	15.04	0.05	1.00
	Second	4.44	11.73	14.93	4.76	12.10	15.07	0.07	1.00
	Third	31.11	29.46	17.87	9.52	15.63	11.93	−2.08	0.06
Weight loss	First	6.67	13.80	13.90	11.90	16.57	16.18	0.93	0.48
	Second	15.56	17.21	13.53	23.81	20.37	16.57	1.02	0.35
	Third	22.22	16.27	14.67	23.81	15.63	15.36	0.27	0.84
Weight gain	First	0.00	0.00	14.50	2.38	8.91	15.54	1.03	0.75
	Second	11.11	16.27	15.83	7.14	14.19	14.11	−0.70	0.59
	Third	4.44	11.73	15.43	2.38	8.91	14.54	−0.54	0.78

Note: EORTC QLQ—H&N35 = European Organization for Research and Treatment of Cancer Quality of Life Questionnaire—H&N35; SD = standard deviation.*p < 0.05

Patients who developed mucositis during RT had lower oral health-related quality of life than those who did not (Barkokebas et al., 2015; Jung et al., 2019). Oral mucositis seriously affects oral functions such as pain, dry mouth, difficulty swallowing, taste, and speech (Al-Rudayni et al., 2020; Elting et al., 2007). In this subject, it was reported that the pain severity increased as the severity of oral mucositis increased in patients receiving RT (Cheng et al., 2010; Murphy et al., 2009). In the present study, it was determined that pain was observed in both groups with the development of mucositis in the second week and the level of pain increased with the increased severity of mucositis in the third week follow-up.

Dryness of the mouth is one of the common side effects associated with RT. Dryness of the mouth begins to occur with the rapid decrease in salivary flow in the first week of treatment in patients who receive 60–70 Gy dose of RT and whose salivary glands are involved in the treatment area (Deasy et al., 2010).

In the present study, it was also found among the most common problems in the first week, and there was no significant difference between both groups in accordance with the literature. In conclusion, it was observed that the use of coffee did not prevent dryness of the mouth.

Nutritional support may be needed in patients in parallel with the pain caused by oral mucositis. The related studies have reported that there is a need for a feeding tube during RT (Elting et al., 2007; Murphy et al., 2009). In the present study, the quality of life scores associated with nutritional need and weight loss were found to be similar in both groups.

When examining the most frequently expressed problems by the patients during the treatment process, the most frequently expressed problems in the first week of the treatment were seen to be coughing, dryness of the mouth, and speech problems. This may be attributed to a rapid decrease in saliva flow in the first week of RT (Deasy et al., 2010). The most frequently expressed three problems by patients in the second week of RT were determined to be additional nutritional support, weight loss, and dry mouth, respectively. This can be attributed to the onset of mucositis and having problems in swallowing. The most frequently expressed three problems by the patients in the third week of RT were determined as the need for analgesics, salivation problem, and teeth problems. It has been reported in many studies that symptoms such as nausea, vomiting, aspiration, weight loss, and fatigue are observed in patients as a result of severe mucositis.

Study Limitations

This study has some limitations. The study evaluated the effect of coffee in the prevention on oral mucositis, but not the long-term effects and repeated measurements. Another limitation the intervention was only performed at one hospital with a small sample, which limits the generalizability of the results. Further investigations with larger sample sizes are required to make the results more reliable. Another limitation is that patients could not drink the coffee at the same temperature. It was not possible to drink coffee at the same temperature for each patient.

Conclusion and Recommendations

In this study, it was determined that the quality of life mean score of the control group related to speech, social communication, and sexuality was lower compared to the intervention group as the severity of mucositis increased. The cause of this may be attributed to weakness, pain, and associated anxiety depending on pain in oral mucosa. It was stated this symptom (eg. pain, weakness, social communication) developed due to mucositis, which seriously affected the quality of life of the patient, while the quality of life increased within 1 year after treatment (Scrimger et al., 2007; Tschiesner et al., 2009). Our study had a few limitations. First, in this research, a small sample size was involved. Future research with a larger sample size and power to detect differences between groups will lead to greater confidence in the findings. We conducted the study only in patients who received head and neck RT. Coffee can be applied in the management of mucositis developing in different cancer types and different treatment approaches.

Consequently, it was determined that the use of coffee did not prevent the development of oral mucositis, did not reduce its severity, and did not affect its development period. Although it has been reported in the literature that the use of coffee and honey mixture is an effective approach in healing oral mucositis associated with chemotherapy, the positive effect of coffee alone could not be shown in this study evaluating the effectiveness of the use of coffee alone in the prevention of RT-associated oral mucositis. Therefore, it is recommended to plan and conduct this study again in a larger patient group with similar diagnosis and treatment.

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